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ABSTRACT

This study explored alternative approaches to teaching and learning high school mathematics through a fluid approach to professional development utilizing cognitive coaching. Cognitive coaching is the application of specific strategies in a nonjudgmental environment, built around a collaborative, reflective planning conference. The process builds trust and uses a critical trusted friend. Four math teachers at one school participated in a two-phased seminar series, embodied techniques in reflective coaching discourses, and translated them into their own mathematics teaching and learning in the classroom. Data were gathered via semi-structured interviews, focus group interviews, videotapes of the seminar series and professional development sessions, and field notes. Through narrative accounts, emerging themes from the various modes of data collection were informed, although not limited, by the conceptual framework. Results indicated features necessary for success of the professional development effort: the principal's support, the coaching approach, reflective thinking, a comfortable atmosphere, a collaborative and nonjudgmental context, and teacher coaching in an atmosphere of trust. (Contains 52 references.) (SM)

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Cognitive Coaching the Vehicle for Professional Development and Teacher Collaboration

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Cognitive Coaching the Vehicle for Professional Development and Teacher Collaboration

By: Enid McLymont and José L. da Costa

Abstract

The pathway for reflection generated by the "membranous boundary" of the Coaching Approach in a collaborative setting, establishes the circularity and reciprocity inherent in the relationship between action and experience relative to the unknown. This study was designed to explore alternative approaches to the teaching and learning of mathematics at the high school level through a "fluid" approach to professional development utilizing cognitive coaching.

Four math teachers in one school participated in a two-phased seminar series, embodied techniques in Reflective Coaching Discourses and translated them for the teaching and learning of mathematics in the regular everyday classroom situation. Data were gathered from semi-structured interviews, focus group interviews, video-taped seminar series and professional development sessions, and field notes. Through narrative accounts, emerging themes from the various modes of data collection were informed, although not limited, by the conceptual framework.

Seven major findings were evident. For teachers to "buy into" any professional development activity Principal support is very important. The collaborative learning community which came about as teachers enact learning experiences allowed for discovery learning and learning by understanding as teachers respect and value each others' ideas. Reflection is the act of making meaning of one's experiences while employing techniques in Reflective Coaching Discourses. The comfortable atmosphere during the discourses is created when verbal and non-verbal messages carry no element of intimidation but allow for freedom of expressions and feelings of security as each one learns from the other. Working together in a collaborative setting on the same problem, maximizes participation and allows for sharing which fosters creativity and flexibility. The grounding for trust in the network of relationships is acting non-judgmentally. Creating a trusting relaxed atmosphere and helping students to arrive at decisions and solutions without imposition is

the function of the coach, the new role of the teacher in the mathematics learning community.

The level of importance that teachers attach to a professional development program appears to be related to the support of the administration. Working in collaboratives aid in learning by understanding. When teachers experience learning by understanding changes in beliefs and attitudes come about before change in student learning but are enhanced by such. Learning by understanding comes about as dissonance is created. When student learning is the chief goal of professional development and the way for this to come about is not prescribed, as teachers learn techniques for themselves they reflect and leap ahead envisioning what they experience in the math learning context. Thus, the coaching approach not only commands but demands reflection. Through the Reflective Coaching Discourses thoughts and concepts are clarified, inadequacies in thinking are realized and elaborations are experienced while that which is recondite is made obvious. The unique history of each individual when brought to fare in a collaborative setting in which there is no competitiveness, allows for the pursuit of different solution paths but arriving at the same end – the solution. Trust allows one to take risks. Therefore, multiple learner perspectives is important in the solution of problems.

Recommendations for theory and practice for administrators, teachers as individuals, teachers as learning communities, and students as individuals are included.

Cognitive Coaching the Vehicle for Professional Development and Teacher Collaboration

> *Even when Mr. D (the Principal) stepped in, I was so engrossed in my coaching, I was not even aware at first that he was there. By the time I found out, it would not have made any difference so I just carried on. But the whole coaching thing made the difference, because of what it did for me. Because if I were probably at the board and he walked in and listened, I would be paranoid. But, because you are there with the students, mingling and explaining, and he gave a suggestion for a particular point in a problem, but I just went on. The whole thing of the sort of fear, not that I was afraid of him, but mentally the coaching really makes you feel as if you are in charge of the class you know really know what you are doing. And even when the suggestion came I did not take it like someone who did not know what he or she was about and you are not doing well enough, but it was just okay.* (Interview, September 22, 1997)

Jamaica, a third world nation, is striving to develop its human resources to face the daunting challenges of the twenty-first century. However, the country is faced with a crucial problem which emanates from the education sector. The failure of many of the nation's youth to qualify for higher educational pursuits or the labour market upon exiting high school is reflected in the low pass rate of the exiting external examinations. A national pass rate in mathematics averaging below 25% each year (The Labour Market Newsletter, 1996) is perceived as a severe disadvantage for the nation. It has been postulated that this low pass rate is due to the direct teaching methodology that is predominantly practised by the nation's teachers. Concern for low mathematics achievement at the high school level led me to contemplate an approach for professional development for the teachers of mathematics at this level to help them to move away from the traditional mode of instruction (direct teaching), toward more promising, student-centred practices.

Thus, this study was conceived as a result of the problem facing the country, and more so, for my two sons who are in high school and have not been doing well in mathematics. Designing a study with the reality of the lack of resources that schools face is a dilemma, as this demand for resources will never be supplied in every school to bring about the desired change. So, I had to design a study which utilised that which was common to everyone in every school. That which is common to every boy and every girl

in the nation's schools is their brain power. And so, the use of one's brain power became the fundamental premise on which this study was designed.

For the portion of study which will be considered in this paper, potential answers to the following question were sought: How can employing a facilitative approach to professional development utilising the vehicle of cognitive coaching be accommodated to inform and empower teachers to develop alternative modes of teaching in the regular mathematics classroom?

Theoretical Significance and Practical Importance

Conducting this study is of importance because through a more "fluid" approach to professional development it began to explore alternative ways of teaching mathematics which can be accommodated in the regular, "everyday" high school mathematics classroom in Jamaica. Little or no research had been done utilising cognitive coaching for the development of alternative ways of teaching mathematics at the high school level nationally nor internationally. Therefore, documenting these experiences for this study adds new dimensions theoretically and practically to the body of knowledge that exists on cognitive coaching, professional development, and teacher collaboration. This serves to inform students, teachers, administrators, college and university educators of the impact of peer collaboration.

Conceptual Framework

The conceptual framework serves as a skeletal structure for justification of explanation based on accumulated experience. It includes the adoption of different points of view culminating in a series and serves as a guide to my data collection and analyses. Given the research problem, the conceptual framework serves as the argument for the usefulness of the concepts chosen for investigation, along with the anticipated relationships among them (Clarke, 1997). The key components, professional development and teacher collaboration, along with other crucial elements are subsumed in cognitive coaching.

Professional Development and Teacher Collaboration Through Discourses

As we journey metaphorically each day with the limitations of the embodied

experiences of our space -- the teaching-learning environment, we realise that this has been encroached upon by the "blind spots" of the direct teaching methodology employed, and the closed doors of our isolated worlds -- the classrooms. Our lived experiences in the classroom have been ones that have been dominated at all levels of the education system by the "pouring out of information into some other human container." Professional development for reform cannot take on the general practice where "experts" are "brought in to transfer" new information and techniques to teachers. The movement from the "direct teaching" mode, which encourages passivity on the part of the learners, to more active teaching methods has to occur as teachers grow. Growth, experienced by teachers as they were engaged as learners, is reflective of the use of teaching methods which they might want to employ, so that their students would have a similar learning experience to theirs (Sparks & Hirsh, 1997).

Professional development means providing teachers with the occasion to reflect and fashion new knowledge and beliefs about content, pedagogy, and how their students, as learners, learn (Sparks & Hirsh, 1997). Professional Development must also have a clear focus. Everything that is done in the professional development setting must begin with the focus of high expectations for all students and providing opportunities for optimum success in student learning (Sparks & Hirsh, 1997). This is brought about through collaboration utilising the vehicle of cognitive coaching.

The limitations of "certainty" depicted by our individuality will be "transcended only in a world created with others" (Maturana & Varela, 1987, p. 16) as we accommodate a level of interdependence. This will bring forth a world, an indissociable network that will establish pathways to be pursued for one to understand some of the difficulties that one is confronted with in the communication and passing on of knowledge in the daily rigours of the classroom experience. This will dissolve the walls of isolation and formality which exist in the teacher's isolated world of the classroom experience, by bringing about more effective communication not only within the classroom, but across the communities which exist in the teaching and learning situation. According to Little (1993) subject-specific teacher collaboratives have been viewed as the alternative paradigm for professional development. A fluid and dynamic model for professional

development which recognises the complexities of the classroom makes allowance for diversity, and allows for the "multiple voices" of teachers to be heard (Spencer, 1996) can be facilitated through cognitive coaching (Costa & Garmston, 1994).

Major educational reforms like the National Council of Teachers of Mathematics (NCTM) have included communication as one of its chief strands to bring about effective teaching and learning of mathematics (NCTM, 1989, 1991). But how do we allow this to come about? Many researchers (e.g., Acheson & Gall, 1997; da Costa, 1993, 1995; Edwards, 1995; Ellis, 1990; Garmston, Linda & Whitaker, 1993; Guskey, 1985; Hargreaves & Day, 1990; Joyce & Showers, 1982, 1988, 1995; Lovell & Miles, 1983; Ross 1992; Showers, 1985; Volkman, 1992) have found that collaboration among teachers is an essential element for professional practice.

Inherent in collaboration is communication which is essential in professional practice for the sharing of ideas and techniques. It is only through collaboration that gaps in our thinking and needful elaborations for successful practice can be supplied. It is the discourses that result from acts of collaboration that trigger reflective thinking and result in effective communication. Therefore, the likelihood for teachers to develop professionally can be brought about while they work collaboratively (da Costa, 1993).

Collaboration that is situated in a non-judgmental setting and one that fosters learning while teachers discuss and reflect on teaching innovations (Ellis, 1990; Joyce & Showers, 1995) is a means for teacher growth and professional enhancement, as together they generate critical yet grounded reflection on what they do (Hargreaves & Day, 1990). Through collaboration teachers' consciousness is raised so that they begin to reflect on observations and experiences so that solution paths and solutions which were recondite could now be made clear, and completeness to germinating thoughts is experienced.

With teachers engaged in a situation that is not given as the answer for, but one which they have to redesign as the solution for the particular problem in the teaching and learning situation, Dewey (1933) stated that the demand for the solution of such "a perplexity is the steadying and guiding factor in the entire process of reflection" (p.14). The fact that "the data at hand cannot supply the solutions; they can only suggest it" (p. 15), then it is the discourses that are generated by these experiences during acts of

collaboration that generate and propel reflection. Reflective thinking comes about as a result of the coming together of individuals communicating about and engaging in that which involves a state of uncertainty, perplexity, mental difficulty in which thinking originates, and also an act of searching and inquiring (Dewey, 1933). It is also looking back upon the past to find that which will resolve the doubt and settle the perplexity. As a result of this collaborative network, discourses are generated.

Discourses according to Gee (1989) is a way of being in the world, a form of life that integrates words, acts, values, beliefs, attitudes, and social identities, as well as gestures and body position. It is socially situated in communicative practices that are constructed in the moment to moment situations (Hicks, 1995), and is a "tool for the establishment and distribution of knowledge" (Riley, 1985, p. 2). Discourse does not consist simply of a succession of turns involving grammatically well-formed utterances (Courtland, 1977), but a combination of, and interrelationships between a number of systems which include language, tone of voice, gesture, body position, physical proximity, eye contact, and facial expressions, all woven together to form the fabric of a conversation (Riley, 1985). According to Hodge (1993), it is also a process by which meanings are understood and passed from one to another by some means of exchange.

This exchange allows for understanding that enables the ones involved to understand what is being said and also allows the speaker to understand what is being understood, so that the intended "information content" (Johnson & Marrow, 1981, p. 95) is the one conveyed and understood. Therefore, listening is a key element in this process as trusting collegial relationships are established while teachers reflect and construct their understanding for the proposed changes (Foreman, 1995). According to Foreman, as these opportunities for sharing in a non-judgmental environment are provided using cognitive coaching, growth is experienced in a forum which honours thoughts and feelings of disequilibrium.

Cognitive Coaching

Cognitive coaching as the application of specific strategies, a way of thinking, a way of working, and a non-judgmental process is built around a planning conference, an

observation, and a reflecting conference. The main thrust of cognitive coaching is for the building of trust, first, then thinking (Costa & Garmston, 1994). Cognitive coaching allows for effective mediation by a coach who constructs and uses clear and precise language to facilitate another person's cognitive development. It diagnoses and envisions desired states of others, and devises an overall strategy through which individuals will move themselves (Costa & Garmston, 1994). To bring about change in teacher beliefs, perceptions and attitudes, teacher's pedagogical skills and student learning, the fundamental elements which are involved in bringing about this change must be taken into consideration. One of the major elements to bring about successful collaboration is trust.

Trust. Many researchers (e.g., Acheson & Gall, 1997; Costa & Killick 1993; da Costa, 1993, 1995; da Costa & Riordan, 1997; Hargreaves & Day, 1990; Lovell & Wiles, 1983) have found that a level of trust for teachers' teaching partners must be established for teacher growth to take place through teacher collaboration. However, when trust is in place, anxiety about the collaborating process is non-existent or at a minimal level (da Costa & Riordan, 1997). Trust allows one to process and make meaning of learning. Recognising how one relates to others of similar or dissimilar cognitive styles, knowing how to draw on the resources of others, and how to appreciate differing views, valuing each person's expertise, perception and knowledge, and how to network, is very essential (Costa & Garmston, 1994). Consequently, trust needs trust to build TRUST, it is a symbiotic process. Trust establishes the foundation for the observation and analyses of one's teaching (da Costa, 1993; Lovell & Wiles 1983) through the eyes of the critical friend.

Critical Friend. Costa and Kallick (1993) advocate the need for a critical trusted friend who will allow one to examine one's own practice through the "eyes" of another. The critical friend provides feedback concerning the significance about the particular practice and responds to the other's work with integrity (Costa & Kallick, 1993). Through the use of elegant linguistic tools of communication (Costa & Garmston, 1994), a non-directive stance is the preferred mode for interaction in order to provide for listening, clarification of ideas, and is very essential for the building of trust (da Costa, 1993).

Method

In mapping out the path for this inquiry in the school system, I solicited the support of the principal of one high school. He was asked to consider this experience as a staff development project for the mathematics teachers in his school. Permission from the school board was received and all of the math teachers in the math department were invited to participate in this Professional Development Project (PD[illegible]ne expectation was that, from the wealth of the experiences of all these teachers along with the accommodation of the PDP experiences I provided, they would be able to embody and pass on what they have acquired to the Mathematics Learning Project (MLP)—the students' version of what the teachers experienced.

It was my vision that the principal's active support would aid in the accommodation of the PDP as well as in accommodation and sustainability of the MLP in this inquiry. All teachers participated in phase one – consisting of the June seminar series of the professional development seminars. This was very important for the pooling of fundamental ideas for the formulation of the MLP and phase two – the September seminar series.

Teachers were invited to meet once per month for a professional development session which would include a debriefing session to share their experiences, suggestions, and reflections on their practice and what has been happening with the students.

Teachers participated in the five-day dual-phased PDP seminar series prior to the classroom experience. Data were collected in June 1997 during the first phase of the three-day seminar series, then on September 3 and 4 -- phase two of the seminar series. Data were also collected from September 8 through to first week of December 1997 in the classroom, and also from the monthly professional development meetings and weekly coaching conferences.

Context of the Work Environment

The Dominion High School (a pseudonym), one of six high schools within a one mile radius situated in a town in Jamaica, was founded early this century as a boy's boarding school. With the humble beginning as an all-boys' preparatory school of fewer than 20 students, the Dominion High School was fully established as one of Jamaica's

leading secondary schools in 1964.

In 1976, the school that had started out as an elite preparatory school for boys became a grant-aided, co-educational government secondary school. The school has experienced growth not only in physical structures but also growth in its student population to about 750. Classrooms which were built for 25, now accommodate an average of 40 students. New blocks are now being built to meet the educational demands of the present student body.

Historically, the Dominion High School has gained a reputation for its high standards and has produced several of Jamaica's noted top scholars. In a survey covering the years 1988 - 1992, the Dominion High school ranked in the top 10 nationally for passes in the Caribbean Examination Council (CXC) Examinations for Spanish, Geography and History and in 1993 the school was ranked first in Business Education on the national level. The history of passes in mathematics at the Caribbean Examination Council (CXC) Examinations has not been one of the subjects which has brought much acclaim as sometimes the pass rate was above the national average and other times it was not. With a pass rate below the national average in 1997, the Principal and the Head of the Mathematics Department reported that "it was really devastating." Hence, the need for certain practices to make a difference to the teaching and learning of mathematics was urgent. For these reasons, the teachers and administrators were willing to accommodate ideas that were different and what they thought would make a difference.

Participants

Four teachers from the Dominion High School volunteered to participate in this study. All four teachers participated in phase one and phase two seminars of the Professional Development Project (PDP).

The study of the Math Learning Project was conducted in one high school in Jamaica for one school term (September to December). Since all math teachers (three females and one male) of the Dominion High School volunteered on the basis of their interest and the envisioned potential of the project, they were asked to form teams of two to serve as reciprocal coaching dyads (teacher dyads). However, the coaching dyads were formed after each teacher tried on his or her own to embrace and accommodate certain

techniques in his or her classes, after which researcher was asked to serve as coach for each teacher in the initial stage of the MLP, then as co-coach as coaching dyads took on the roles of coach and coachee.

The teachers in this study, although unique individuals, share many characteristics with the majority of teachers in the Jamaican situation, in that three teachers had formal teacher training whereas one had no formal training. The years of teaching at the high school level for this group ranged form 6 to 20 years all teaching at this same high school with the exception of one teacher who taught for four years at this particular high school.

Data Collection

Several data collection techniques were employed in this study. These techniques included: (a) semi-structured interviews, (b)focus group interviews, (c) video taped seminar series and professional development sessions, (d) audio taped coaching conferences, and (e) field notes.

The extensive use of ongoing reflections and interactions during the seminar series and monthly professional development sessions were video-taped and audio-taped. Questions posed, were informed by the various activities. Semi-structured interviews of 30 to 90 minutes duration were used with teachers individually, as well as, in focus-group format of 30 to 120 minutes duration. The coaching conferences, lasting from 20 to 30 minutes, were audio-taped.

Teachers were interviewed individually using semi-structured interviews in June 1997 prior to the PDP sessions, and at the end of the term in December. Open-ended questions were used in September, October and again in December where all teachers together as a focus group were interviewed. Data from field notes on class observations, conversations and meetings with individuals, served to corroborate findings of other data sources.

Trustworthiness

Techniques inherent in communication which were employed during interactions, served for veracity of interpretation, while intertextuality served to corroborate findings among and between cases (Fillmore, 1985). The multiple-embedded cases (Yin, 1994) which the teachers and their classes facilitated allowed for triangulation. To enhance the

trustworthiness of the study, information gleaned in one setting was always re-attended to in another with the same individual as well as shared across cases to see how similar or how different applications were made.

The multiple modes of data collection corroborated similar concepts and allow for the development of convergent lines of interpretation. Cross-sites (teachers' classes) allowed for similar or contrasting information themes or findings depending on the differences or similarities which existed in the various situations (Yin, 1994). To ensure anonymity the use of pseudonyms was employed to conceal the identity of the individuals and the institution.

Data Analysis

Data gathered were transcribed and analysed. Through narrative accounts, emerging themes from the various modes of data collection were informed by the constructs in the conceptual framework. The conceptual framework, however, did not limit the analyses since themes were also sought using inductive data analyses techniques.

The themes have been induced from the data which account for the ways that individuals experience, interpret, understand, perceive or conceptualise aspects of their coaching experience and the activities in which they were involved.

The Process

Teachers were informed that the professional development would take the form of an initial five-day seminar series which would be presented in two phases. They were also told that they would be exposed to certain techniques which might not bear any obvious relevance to the teaching and learning of mathematics. These were techniques they would have to tailor for "reproduction" in the teaching and learning of mathematics. Also, each month we would meet to share ideas regarding what was happening in the classroom and with each person. This sharing went along with regular professional development activities. On September 22, 1997, teachers met and shared their overall reaction to the June and September seminar series. They also shared how they were "translating" the ideas in their classes. By October, the professional development session was no longer my monthly PDP meeting but the monthly PD meeting of the Math Department. This was planned and arranged by the Head of the Math Department. However, my ideas for the

monthly meeting were carried through. On December 5, 1997, in a focus group interview session, teachers gave their overall impression of the impact of the program on themselves and on their students. The Principal attended this session.

Throughout the term, teachers worked in coaching dyads. Each coaching dyad was asked to engage in a minimum of one coaching cycle every two weeks for the school term. Each coaching cycle consisted of a pre-conference, class observation, and a reflective conference; these events reflect the principles suggested by Costa and Garmston (1994). Even though this was the request, the teachers saw it fit to have weekly cycles for each teacher for the honing of particular skills and techniques inherent in the coaching approach.

The Interviewer as Co-Coach and Critical Friend

I, the interviewer, was also co-coach. In this role I had the opportunity to observe all the teachers' classes after they felt comfortable enough to invite me. The techniques employed in coaching served to verify information received in each setting. Also, as co-coach I always helped the teachers to make connections between one coaching conference and the next, each succeeding session provided the wherewithal for teachers' veracity of interpretation. Most times, I as co-coach, shared information across dyads. Everyone, as it were, was made transparent to the other.

Findings and Discussion

This section begins with background comments and nature of the seminars. The findings and discussion section is divided into six sub-sections each focusing on themes which have emerged from the data.

Background Comments and Nature of Workshop.

The math teachers at the Dominion High school have been in this setting from a minimum of 4 to a maximum of 20 years. They have never been involved in any collaboration except for departmental meetings. This allowed for some sharing of ideas and techniques, but at a minimal level. Since this did not take place on a regular basis, teachers saw the need for sharing and wished they had more opportunities for such (interview, June 15, 1997). Therefore, ensuring that the program that I had to offer was congruent with their needs was very essential for teachers to accommodate the project.

However, I am mindful of Guskey's (1985) suggestion that ensuring that the project aligns with teachers' needs do not bring about change in attitude or elicit commitment.

Principal's Support

The Principal's support for this Project had been optimal from the very start. When I first submitted my request for the participation of the math teachers and one of their classes in this Professional Development Project and the Math Learning Project, the Principal informed the teachers and encouraged them to participate. At this initial stage, everyone was alerted even before the finer details were known. Fullan and Miles (1992) accentuated this as they stated that, "reform is systemic," (p. 479) therefore, for it to succeed the essential connections based on the knowledge of what is involved have to be made not only during the process but before the process is set into action. This action on the part of the principal was very important in raising the consciousness of the teachers long before I entered the situation.

Upon my first visit to explain the details of what were involved, the Principal invited his Vice Principal and the Head of the Math Department to meet with me. He explained that he had invited his Vice Principal and Head of Department so that they could learn of the details and work out all the intricacies in order to take on the program (Notes, June 11, 1997). Local involvement of representatives of the hierarchy of those who will be directly involved was crucial for the effective accommodation of the new venture. For any reform program to be effectively accommodated, mandation is not the way to go, having everything pre-designed and pre-set is not the best approach, but having those who will be involved become a part of the planning and decision making process from its inception is key. Lewis (1997) also shared this viewpoint as she stated that several researchers have recommended from their findings that for the creation of a shared purpose everyone in the school community should be involved.

The Principal also stated that he envisioned that time table changes would probably have to be considered. So they decided on dates that would be best for them for the first phase of the seminar series and also set a tentative date for phase two (Notes, June 11, 1997). It was very important that this group take an active role in the planning so that ownership became theirs and not that of the external person – the researcher. For any

reform to succeed, power is required. Fullan and Miles' (1992) proposition support this action as they stated that reform involves change and change cannot be managed from afar, therefore, "local implementation by everyday teachers, principals, ... and students is the only way that change happens" (p. 752). So from the inception, power had to be passed on to this group. According to Fullan and Miles (1992) this is best carried out by "a cross-role group" (p. 751) as was done in this situation involving administrators, department heads, teachers, and later students. With the involvement of a cross section of the hierarchy, Fullan and Miles stated that more learning is likely to occur as the "different worlds collide" and the accommodation of the new venture will be managed realistically.

Entering into the situation in mid-June was a very busy time for teachers as they were trying to bring closure of the topics they were teaching in order to enter into the end of year examinations. Time table changes were made as teachers were rescheduled for the invigilation of examinations, so that they could be free for the three-day seminar -- phase one which they set. Again, in September, for the first week of school teachers were freed for attendance in the second phase of the two-day seminar series. The school administrators had all math classes from the First Form to the Fifth Form (Grades 7 to 11) all amalgamated with other subject teachers' classes, so that teachers could be free for the seminars. Lewis (1997) endorsed this as she stated that several researchers have recommended that school structures should be redesigned to support teacher learning and collaboration when serious attention is being given to practice.

A block of time was created in the time table for the September school year so that all math teachers could be free for two class periods each week to allow for meetings when needed. The timetable was also arranged to allow for specific coaching dyads to reciprocate their roles. Lewis (1997) supported this as she stated that several researchers who have worked extensively with professional development in schools have found that re-thinking schedules for staffing patterns to create blocks of time for teachers to work and plan together enabled schools to accomplish their desired goals. "Time is energy," (Fullan and Miles, 1997, p. 750). Fullan and Miles supported the action of this administration as release time and re-designed schedules made allowance for the extra

energy that was required to include the extra space for that which meant extra work. This, they stated is essential for the success of any project.

This initial arrangement, however, did not continue throughout the term because new math teachers were hired. This necessitated rescheduling of time to accommodate some classes for them. In October, a new time table was made which could not accommodate the block of time for all math teachers to meet, neither did it allow for pre-designed coaching dyads. This did not prevent teachers from meeting in a collaborative setting as teachers maximised the use of their lunch time and after school hours for scheduled coaching sessions and for meeting as a group. Because of teachers' interest in honing the new techniques and their enthusiasm to see it work in the classroom, time for planning and meeting did not become a barrier. This is supported by da Costa and Riordan (1997) who found that when collaboration between coaching dyads was meaningful teachers found innovative ways to overcome the limitation of time.

Throughout the term the Principal and Vice Principal, on an informal level, continued to take "temperature checks" enquiring from teachers and myself how things were progressing. The Principal and I had regular unscheduled meetings "just to talk" and to keep Principal informed regarding what was taking place. Fullan and Miles (1992) also supported this as they argued that initiatives that engender change cannot run by themselves as change requires power, therefore, keeping everyone informed with what is happening is crucial to success. Students' written reflections on what they were experiencing were also shared with Principal. The Principal, a math teacher, was Presenter at the October 22, 1997 professional development meeting, sharing his ideas and techniques for the teaching of geometry. The Principal's active involvement, sharing his professional knowledge and even taking a teacher's class at times to allow the teacher to observe another teacher's class as part of the coaching process fostered the success of the project. In Reforming the Teaching Profession (1997), Darling-Harmmond also supported this by stating that opportunities for teachers to serve as critical friends should be created so that they can observe each other while teaching. This requires re-thinking the schedule to make time available for teachers. In the same vein, she stated that principals and assistant principals could substitute for teachers in their classes. With the Principal

becoming a part of the lived process aided in the growth process and added to the efficient running as decisions were shared. The Principal also stated that he would also like to experience the coaching from one of his teachers (Group Interview, December 5).

The support of the Principal and his administration allowed PDP to become a part of the everyday life of the school and so support became an integral part of the school's culture. It was never treated as an addition, but as a part of the everyday affairs. Joyce and Showers (1995) supported this, as they found that coaching flourished best in situations where Principals have taken active roles, supporting, and providing help. According to Wood, Killian, McQuarrie and Thompson (1993) as cited in Hodges (1996) "Principals are the gate keepers of improvement in schools... and what principals do ... is important to the success of a staff development effort to improve school practice" (p.74). This statement supports my experience in this school situation, and allows me to endorse Hodges' recommendation that "the context for staff development should be one of ongoing administrative and cultural support characterised by norms of collegiality" (p. 247).

Therefore, for any reform project to work it must also focus on interrelationships. The interrelationships of all the key aspects of the system must be taken into consideration so that the salient issues of the culture of the system can be made the focus instead of regulations and mandations (Fullan & Miles, 1992).

A Different Approach to Professional Development: The Coaching Approach

The teachers involved in coaching invited the three new teachers to participate in the October professional development session in order to share their experiences with them. From the sharing of experiences with the new teachers during this session, one of the new teachers deduced that coaching is an approach rather than a method. Distinguishing a method from an approach, he said, a "method" is used only in the teaching of particular topics in a subject area that lend themselves to its use, whereas, from what he gathered from the shared experiences is that, coaching is an "approach." An approach, he explained, is one that can be used for **any** topic in **any** subject area. With this explanation all teachers based on their experience with cognitive coaching, agreed that it was an "approach" (Professional Development, October 22, 1997). Hence, the

"Coaching Approach" is a different approach for teaching and learning.

The reason for having this Project at the school was to develop alternative approaches for the teaching of mathematics to bring about learning for understanding, this was always kept in the forefront of each participant's mind. As they reflected on the low pass rate in the external examinations one participant remarked, " *it was not lack of teaching or lack of content on the teachers' part"* that resulted in the students' failure on the examination. "*We were pouring out and nothing seems to be staying in, so I was convinced at the workshop.*" Hence, after experiencing the Coaching Approach in phase one of the PDP, which they claim was different, because it allowed individuals to "*embrace*" particular techniques instead of the usual "*pouring out into*" they decided that "*it was worth it*" as they anticipated the experiences within the classroom. Sparks-Langer and Colton (1991) reinforced this by stating that "no longer is direct teaching or 'training' the best mode for professional staff development" (p. 43). So, since PDP made a difference for teachers, a difference in learning outcomes for students was anticipated. Another participant remarked,

> *So when you came up with that which was a different, this different approach ...I said that has to be our weakness, our students regurgitate from memory what we give them, but if the question is twisted because they have not embraced it, it is that they can't use their knowledge effectively. And so, when you talk about embracing, I was sold from that day so I was very eager to get that sort of change very early. So taking on this approach I was more convinced not forced.*
> (Interview, December 9, 1997)

Teachers were sold on the particular approach based on what they experienced in the initial stages of the workshop long before they were able to try out anything with students. This is contrary to Guskey's (1985) proposition that significant changes take place in teachers' beliefs and attitudes "only" (p. 58) after enhanced student learning outcomes. Change in attitudes and beliefs, to a great extent, started with teachers as learners themselves in the initial stages as they reflected on their own experiences in the seminars and their changed behaviours.

PDP was designed as I envisioned the change in the mathematics classroom climate that would engage students in meaningful metacognitive activities which would aid

in the development of their abilities to explore, develop their mathematical understanding, and develop multiple solutions to the same problems. The design of PDP was to provide the same experiences for teachers so that understanding and not facts could be taught (Lewis, 1997). Lewis' statement that it is believed that teaching by telling is being replaced by teaching for understanding supports my premise.

The teachers' experiences of PDP were ones that demanded maximum participation from each individual. Each one understood and learnt what was intended. Opportunities for knowing lie in one's doing, then reflecting on the act and making connections in a collaborative net work to allow for authentic learning. Fullan and Miles (1992) reinforced this by stating that learning is understanding and becoming good at something. When this is done it gives a deep sense of ownership at the beginning and becomes stronger at the end. One participant explaining what she experienced stated,

> *Putting everything else together you learnt, you participated, you got a chance to revisit what you learnt, also you got a chance to put that which you have learnt into action. And after that, you were able to evaluate it immediately. Whether or not you thought it would work or whether or not it could work. Rarely in seminars you get that chance. Most times you are lectured to, and you are expected to make this work. But in this seminar the difference was, you were able to participate, you are able to immediately put the thing into action and therefore, you could get a feedback while in the conferencing activity.* (Interview, September 22, 1997)

Teachers are empowered as they are given the chance to revisit what they learn. As they were brought together in collaborative relationships (da Costa, 1993), the opportunities to revisit what was enacted provided grounded reflection on what they did (Hargreaves & Day, 1990). Therefore, teachers experienced that which was similar to what would be happening to their students (Sparks & Hirsh, 1997) this helped them to experience the gap to be bridged between themselves and their students. As I led them through the experience, they also became aware that their roles had to change. As one participant said, her role in the classroom has changed from the "*telling and directing*" to one that is "*more mediating, coaching, listening and redirecting*" through the Coaching Approach (Interview, December 9, 1997).

The Coaching Approach demands reflection on action and experience, revisiting

and evaluating what is learnt, making new meaning and forming connections by doing. This is supported by the NCTM Standards, (1991) as a way for learning to happen. It is teaching for understanding. It is not only thinking about thinking – metacogitating, but redirecting one's thoughts and voicing the perceptions, so that the pooling of the thoughts that are voiced in the collaborative network opens up a highway of possibilities. As one participant stated,

> *The coaching helps to redirect your thinking. So even if you are just on this one track road, it would have opened up an entire highway, these are the possibilities and definitely when you go to the class these are the possibilities and more.* (Interview, December 9, 1997)

As a result of the dynamic process involved in the Coaching Approach the teachers were led to a new level of understanding, instead of the acquisition of factual knowledge (Duke, 1990) or just the practising of a set of skills as was done in the "old school." This is in harmony with what is advocated by the NCTM Standards (1991) which stated that learners should be stimulated to redirect, clarify, and extend their thinking. This should be done with information that is not totally "new" but with that which they are familiar with, so they can co-ordinate and extend their knowledge base while utilising that which they already possess. Jonah, one of the participants in the seminar remarked,

> *I think we are being made consciously aware of elements that we were already utilising, but not in the co-ordinated form, lending to the effectiveness of the whole as it is. We are co-ordinating, taking and putting them into a whole as we pool our ideas.* (Seminar, June 26, 1997)

This is partially supported by Showers, Joyce and Bennett (1987) and Spencer (1996), who advocate that teachers' multiple voices must be heard as they bring to staff development their knowledge, skills, perceptions, and needs which should be taken into account. Guskey (1985) recommended that for staff development to be effective the way new practices should be implemented should be clearly illustrated so that disruption or extra work will be at a minimum. He further stated that changes required of teachers should be clearly delineated in small incremental steps. I do not agree with these statements as we don't really learn that way. We don't learn in a linear way, and it is only

as dissonance is created that we will work ourselves through the maze and find that opening – the way to do. This is the kind of learning that will never leave an individual.

It was only with an idea of the end in mind, that Jonah was able to reflect and deduce that what he was doing in this initial stage was drawing from the reservoir of his experiences and the experiences of others, and co-ordinating them to create a package from which he would have been able to draw at a later date.

The parallel that existed between teachers as learners, and students as learners, is that, both sets bring to the learning situation their history of previous experiences which should be utilised in the solution of problems. As Jonah acknowledged, the history of their own experiences were taken into consideration as they were allowed to constantly draw from them. This was also in keeping with Spencer (1996) and Sparks and Hirsh's (1997) call for more fluid and dynamic models of staff development that will lead to new levels of understanding (Duke, 1990). According to Sparks and Hirsh (1997) teachers in this mode will have the opportunities to discuss, think about, try out, and hone new practices while creating a culture of enquiry.

The parallels which exist in the teachers' world and the students' world also exist in the way they work, where each works alone and as it were in silence (Silver & Smith, 1996). Whereas, prior to PDP teachers existed in the private worlds of their teaching, the activities were designed to liberate them from their isolation by dissolving the "walls of privatism" through collaboration (Hargreaves & Day, 1990). The subject-specific teacher collaboratives as suggested by Little (1993), and the nature of the activities made a difference. The way the activities were enacted did not bring with them prescribed ways of doing, neither were they predetermined or constrained by a narrow set of outcomes but they allowed for diverse possibilities of outcomes. This came about as a result of the "membranous boundary" of coaching which allowed for all interactions within that entity.

The space of each teacher's world was also being extended to accommodate others without the teachers being made consciously aware that this was the intended objective. As the various activities were enacted by teachers, they were grouped randomly using strategies which did not make it obvious that grouping was one of the prescribed objective to be achieved. The interactions lent themselves to diverse possibilities or

multiple solutions as teachers reflected. To the teachers, what was learnt seemed as incidental learning as they engaged in the grouping techniques and activities which allowed for collaboration. Collaboration which was done in such a way that individuals were led to value each other's ideas and suggestions. Reflecting on the experiences in PDP one participant remarked,

> *We did not even realise that we were being placed in groups, we thought that it was just an exercise. We were made to realise that, we and the other person had so much in common and so we learnt so much from the next person through incidental learning.* (Seminar, June 25, 1997)

This collaboration served to build a learning community. Each teacher learning from the others as the discourses were generated. In Reforming the Teaching Profession (1997) Darling-Hammond accentuated this by stating that professional development should take place within a professional community, a net work or a team.

To add to the difference of the nature of this Project, one participant noted that this approach maximised students' participation and developed the creativity of the students as well as that of the teachers. Whereas, other professional development activities from her experience focused on the development of the teacher's creativity only (Interview, December 4, 1997). The Principal reinforced this by saying "*there is a strong variation*" of PDP from other professional development models, as other models utilised the traditional approach of lecturing. Traditional professional development models also "*target teachers as individuals*" whereas, the PDP targeted teachers as a group. He further stated that students are now seeing teachers more as "*people who can make mistakes.*" He now sees teachers as "*not being syllabus bound, which is good for the students, as students are now allowed to think and learn and understand fundamental principles. Now, they are also more able to work on their own*" (Interview, December 5, 1997).

Whereas prior to PDP teachers utilised the direct teaching methodology as their chief way of helping students to learn, and so they were always telling and showing students how to do, instead, they are now allowing the students to learn by understanding for themselves the concepts they need to learn. This is supported by the US Department

of Education (1996) TIMSS report which stated that the US teachers who typically use the direct teaching method, their goal is to teach students how to do something while Japanese teachers' goal was to help them understand mathematical concepts.

The nature of the PDP seminars taking on an approach which was not the usual, but a more fluid nature (Spencer, 1996) allowed everyone the chance to participate and learn at the same time. This, spells to the uniqueness of the nature of PDP. Also, the fact that teachers were not targeted as individuals which would have allowed the perpetuation of the isolation of teachers, but one that targeted teachers as a group, allowed for collaboration. So, even after researcher is out of the situation, teachers would want to continue to learn from each other. Teachers were now refocused to allow students to discover and develop conceptual understanding instead of "covering" the syllabus.

Reflection: The Act of Making Meaning of One's Action

It is only as teachers make meaning of what they do through the genre of reflection, that they will be able to "reproduce" what they experience. To reproduce this experience, they will have to embody it, and then tailor what I have passed on to them into experiences that are suitable for the mathematics classroom. What I had done in PDP had no obvious relationship to the teaching of mathematics. It was like someone speaking Spanish to me to communicate what is said to another person in his own language. First, I have to make meaning of what is said to me in the context of what I know and understand (assimilation) before I begin to think of a translation for others. Therefore, for the teachers to be able to "reproduce" this experience for the mathematics classroom, they first had to embody and make meaning of it in the context of their own experiences, then reshape and organise it in order to effectively devolve it to others (accommodation) in a way that it would be understood. Thus, through reflection, the dual process of assimilation and accommodation is embedded in creating one's own meaning is supported by Sparks-Langer and Colton (1991).

Through modelling and practice, teachers were provided with first hand experiences as well as vicarious learning (Bandura, 1977) which served as the occasioning for the "network of metabolic" interactions. It was these interactions that gave "life" to this entity as ongoing opportunities were provided for reflection. Sparks-Langer and

Colton (1991) reported that in a study on reflective thinking it was found that coaching may help to promote reflection. It was through reflections on their experiences in PDP that teachers were able to come up with their own definitions, meanings, and application of particular concepts and techniques which were being explored in the Coaching Approach. Each person's way of expression of the translation or reproduction of his or her experience was different yet bearing the common threads of the salient elements of the package. According to Maturana and Varela (1987) "all doing is knowing and all knowing is doing" (p.27), so ongoing reflection was a natural reaction to all that was done. For example, after a particular coaching exercise one participant based on his experience was able to formulate a definition for coaching similar to Costa and Garmston's (1994) definition. He stated that

> *Coaching is a means of conveyance. Cognitive coaching is helping an individual to think through a problem situation. It can also be described as the ability to analyse, synthesise, and simplify. It helps the individual to evaluate and assess a situation through the use of good questioning technique. The coaching exercise is basically one that helps the person to make a decision about his or her idea. It helps the person in that, if he needs to make a decision on a particular issue it is done without interference from the coach. It is a facilitating role, not a dictating role. As a coach you are a facilitator not a dictator.* (Seminar, June 24, 1997)

Others, through vicarious learning were able to make additions to his definition of coaching based on what they observed. As they reflected they stated that, it is also the sharing of ideas, and helping a person to make his or her own decision by exploring his or her inner thoughts, to achieve a particular goal while not changing the person's goal. One participant added that, "*It is listening. It is questioning. It is paraphrasing. It is a creative process ...and a facilitator of decisions*" (Seminar, June 24, 1997).

While teachers were observing the model, they too were formulating their own questions as mentally they were being carried through the process. This was because there were no prescribed questions, not even the questioner knew what the next question was until it was asked. This was brought about by the "membranous boundary" which cognitive coaching allowed. Consequently, persons observing were being conveyed along

the journey that was being mapped out without taking detours. Through anticipation, their own questions that they would have asked were racing through their minds. They were also thinking of alternatives. Hence, by living the particular experience or becoming a part of the experience vicariously, it became everybody's experience. As they engaged in these metacognitive tasks (Garofalo & Lester, 1985) a variety of decisions were made.

The circularity and reciprocity inherent in "knowing and doing" and "doing and knowing," came about through the constant reflection situated in the Coaching Approach. As the pathway continued to be opened up before us, the teachers were led through a direct teaching exercise. The excuse was time constraint and so it was a natural reaction to do what we did. So again, this was not viewed as an exercise, it was seen as a way of doing. After the exercise, teachers were questioned about what they learnt. They all went back to their notes, as they were told to take notes. One teacher had left the room after the "teaching" exercise and returned after everyone else had given his or her responses to the particular questions. Without directly or indirectly calling attention to the way he would respond, it was with interest and much laughter that we observed how he responded to the particular questions. True to form, he too went back to his notes to retrieve what was given by the "teacher." Reflecting on this experience one participant deduced that

> *I think this is basically what happens to our students (laughs). I do believe this. Here it is, in almost note form, point by point, the information was given back (Laughter—everyone). It was as if, if he did not have the paper, he would not have been able to respond...* (laughter). (Seminar, June 24, 1997)

As teachers envisioned the uncertain outcome of the professional development experience they were constantly examining their past and projected future experiences in the classroom in light of the present. The fact that everyone had the same notes, everyone responded giving information in the same order with difference only in the choice of words. The rigidity that was displayed was obvious to everyone and they were able to compare this direct teaching experience with the other experiences where they worked in groups and independent thinking was done. Because they were so tied to the notes, they did not make the connection or even recognised that it was the same thing that was

modelled previously as cognitive coaching. The only thing they could think of was the notes that were given. Comparison of this experience to the traditional way of teaching mathematics (direct teaching) and the reality of their own experiences were revisited.

"Reflection is the act of knowing how we know. It is the act of turning back upon ourselves" (Maturana & Varela 1987, p. 24) and examining our experiences while translating or reproducing them for the mathematics classroom. It is the act of seeing the limitation of our isolated paths, and allowing for the exploration of alternatives in the network of collaboratives utilizing the membranous boundary of cognitive coaching to produce what I have coined *Reflective Coaching Discourses*.

Reflecting on the total experiences which had no prescribed way of how it will devolve in the mathematics classroom situation, Jonah in the first phase of the seminar series, curious about the application of these experiences in the classroom, stated, "*I wonder if these innovative techniques can be brought to fare on a larger scale so as to effectually revolutionize our teaching and learning situation?*" So already in the first two days of the seminars the revolutionised teaching and learning experienced by teachers as learners were allowing them to project their thoughts in anticipation of the teaching and learning of mathematics -- the MLP. According to Dewey (1933) demand for the solution of a perplexity is the steadying guiding factor in the entire process of reflection," (p. 14) therefore, the demand on the mind for the solution of the uncertain always guides the entire process. The observations voiced during the discourses by myself and others suggest the possible paths to the solution and so these made demands on the mind and caused one to jump from the known to the unknown. So through the *Reflective Coaching Discourses* one is always looking back upon past experiences as well as leaping ahead to project the thoughts on that which is unknown. This is also supported by Dewey (1933) who stated that "we consider the possibility and nature of the connection between the object seen and the object suggested as the seen thing is regarded as in some way the ground or basis of belief ... it posseses the quality of evidence" (p. 10).

When student learning is established as the chief goal of the professional development experience as is advocated by Sparks and Hirsh, (1997) and when they are not given a pre-designed package for implementation, then by constant reflection in a

collaborative setting they are allowed the opportunity to embody principles and techniques. They were constantly metacogitating on what they were learning and how that which they were learning could be fashioned for the classroom situation. This is supported by Garofalo and Lister's (1985) stance that metacognitive knowledge includes *where* knowledge can be used, *when* it can be used, and *how* it can be used. This is also echoed by Spencer (1996) that a growing body of research has shown that teachers are not passive consumers of innovations but will adapt them to meet their needs in the classroom situation.

In Sparks-Langer and Colton's (1991) synthesis of research into reflective thinking, three elements of teacher's reflective thinking; the cognitive element, the critical element, and teachers' narratives have been found to be very important in the promotion of reflection. How teachers process information and make decisions is described as the cognitive element, while the critical element focuses on what drives the thinking, that is, the experiences, goals, values and social implication. The teachers' own interpretation of the events that occur within their own particular contexts is referred to as teachers' narratives (Sparks-Langer & Colton, 1991). These three salient elements which exist in separate and unconnected paradigms are bounded by the Coaching Approach and are subsumed in the *Reflective Coaching Discourses*.

Reflective Coaching Discourses. *Reflective Coaching Discourse*, a term which I have coined evolves out of the use of cognitive coaching. It is an interactive social process by which ideas, knowledge, notions, problems, and intent are explored through the reciprocity in roles and genres in a non-judgmental atmosphere. It is concerned with understanding as the questions generated in a collaborative setting probe or mediate for clarification, elaboration and intentionality. It forces one to listen as one acknowledges, empathises, synthesises, summarises, and restates what was understood from the message conveyed. It involves standing aside and looking "back on ourselves" and "knowing how we know" (Maturana & Varela, 1987, p. 24). It is reflecting on the experiences in the path which had been pursued to inform that which will be pursued. It involves looking ahead to mentally explore the paths to be pursued.

Reflective Coaching Discourses is a self generating system. It is that which is

generated when solution paths and solutions are not foreseen. The problem serves as a "guiding factor"(Dewey, 1933, p. 14) in the reflective process as past and present experiences suggest pathways to be pursued. It is a system that involves circularity and reciprocity, where cognitive coaching provides the boundary to allow for the occasioning of this circularity, so that the reservoir of one's mental resources will be tapped in a comfortable atmosphere.

The Comfortable Atmosphere

Among the system of "metabolic perturbations" inherent within the environment of interactions, was the freedom to express one's ideas without any feeling of intimidation. This led to an extension of each persons' knowledge of or about the particular concept that was being explored. No intimidation by verbal or non-verbal messages was conveyed, so cognitive coaching lent itself to a comfortable trust building situation. Revisiting one's experiences and comparing them with one's usual practice in the *Reflective Coaching Discourses*, one participant noted that, one of the things that stood out to her was

> *... the freedom of oral expression. We were able to express ourselves in a very comfortable atmosphere and sometimes in the classroom we as teachers do not have that open mindedness. By our body language we shut up the child. The child wants to say something but we stop him, but in this seminar we realise from our experience that we can learn so much from the child if the ideas he has he is able to share them orally without anyone being judgmental.* (Seminar, June 1997)

The idea that the reciprocity of learning allows for horizontal as well as vertical learning to take place became an integral part of the mathematics teaching and learning community. What I mean by horizontal learning is the two-way sharing process between teachers and teachers as well as students and students. On the other hand, vertical learning is a two-way process which takes place between teachers and students and students and teachers. The idea that horizontal as well as vertical learning take place when opportunities are made available to express ideas in a non-judgmental setting, is very important in the forming of collaboratives. In this situation everyone is free to express their thoughts. As another participant reiterated, "*the environment was created for you to feel secure and just to be yourself. Whatever you are saying there is no one to tell you that ... your idea is not necessary or not important*," (Interview, September 22, 1997).

The *Reflective Coaching Discourses* allowed each individual to feel unique and respected. It provided the setting for acceptance, the freedom of expressions, and a feeling of security. The flow of thoughts was not impeded in the process but allowed for spontaneous thinking in any situation. The comfortable atmosphere generated a positive climate helping individuals to experience a feeling of acceptance by everyone, thus leading to a willingness to share. Reflecting on a coaching experience one participant stated, "*I did not know that ... I could think so quickly on the spot, but the relaxing atmosphere that as a coach ... you created helped me to respond very freely and positively* (Seminar, June 25, 1997). According to Georgina,

> *If there is a comfortable situation between teacher and students there will be openness, they will be free to say what they want to say, their self esteem would be improving and they will feel accepted and willing to share.* (Seminar, June 25, 1997)

This was a true reflection of Georgina's own experience in the workshop situation. As teachers took turns in sharing their ideas, initially, she would not volunteer her thoughts, even when called upon she would say someone else expressed what she wanted to say. Techniques involved in communication were utilised to get her to share, but the immediate success was not evident. However, another teacher who sat beside her, took the paper on which she jotted her thoughts and shared what was written. The fact that I did not make any judgmental comments about her idea but accepted it for what it was worth, led her to feel that her idea was valued. I commented on the particular idea as the next issue to be explored, as it was the foundation for the communication network. Georgina then took the sheet of paper from her colleague and started sharing her other ideas freely (Video-tape, June 25, 1997). Each idea was considered for its merit within the situation. I never had to prompt her again to share her ideas, she volunteered them, her ideas were important. Another participant expressed her comfort in this way,

> *I felt good about the seminar because it was one in which everybody could participate. As you said our input was just as important as the Presenter's input. The atmosphere that was created in the seminar is one in which you felt that even if you were objecting or even if you thought you were saying foolishness it was important, it was worth the while saying, and so it gave you that comfort. It was a comfortable situation.* (Interview, September 22, 1997)

Reflective Coaching Discourses provided the avenue for openness and freedom of expression which led to a willingness to share, and generated a feeling of acceptance and improved self confidence. Vic had read from Gerogina's paper "*student need to trust teachers in order to feel comfortable*" (Seminar, June 25, 1997). So trust is the grounding or the foundation for a comfortable climate which engenders openness and sharing which are very important to ways of making meaning by knowing and doing.

Collaboration Brings Sharing in the Non-Judgmental Context

The atmosphere that was generated in the collaborative setting, brought with it sharing. The sharing of different ways of doing, the pooling of ideas in a comfortable atmosphere fosters creativity as each person derives his ways of "doing." It opened up alternatives, in that, individuals' minds were not closed to one person's way of solving a problem, as in the direct teaching method, but each person took a particular solution path unique to him or her. Each person experienced the total situation in coming up with alternative ways of doing.

Reflective Coaching Discourses is collaboration. The assignment of roles in groups for particular tasks (Hill & Hill, 1990) lends itself to a collaborative setting. As one participant stated, "*we are sharing more in this situation, you might come up with A and I come up with B, and we all get it together*" (Seminar, June 25, 1997). "*We all get it together*" meaning everyone pools their ideas even though they might be different. They all work together on the same aspect rather than on separate components as is advocated by Damon and Phelps (1989). They view the same aspect from different perspectives, so as one participant stated, "*Everybody comes together to come up with the solution, whereas, in co-operative learning each person comes up with a different aspect*" (Seminar, June 26, 1997).

The comfortable situations lent themselves to the sharing of ideas as each person was made to feel that his or her input was important and worthwhile. The situation also lent itself to maximum participation of not just some individuals, but everyone. One participant stated that he became aware that many times "*we don't 'see' an alternative to a situation because we are used to doing a particular thing in a particular way,*" but "*the*

alternatives are right there in the classroom." Therefore, when opportunities are given to share, these alternatives are made obvious (Seminar, June 25, 1997).

Reflective Coaching Discourse allows for flexibility and prepares you to be open to alternatives. As another participant stated, during the coaching process, you may come up with one or two alternatives to solve a particular problem, "*but when you get into the classroom the students might not use your method or the one that was recommended during the coaching, but the coaching helped you to be prepared for the alternatives*" (Interview, December 9, 1997). As has been stated earlier it opens up a web of possibilities. So coaching allows everyone the opportunity to share so that a network of alternative paths to the solution of a problem can be undertaken through working collaboratives which command maximum participation on the part of all involved. This is partially supported by one of the findings of the US Department of Education (1996) in the Third International Mathematics and Science Study (TIMSS) where it was stated that Japanese "students were assigned to invent new solutions, proofs, procedures on their own which required them to think and reason. However, whereas Japanese students worked "on their own" the students in MLP worked in collaboratives. The US Department also stated that "Japanese teachers ...designed the lesson in such a way that students themselves derived the concept from their own struggle with the problem." This is unlike the experience of teachers and students in PDP and MLP as "struggle" suggests a difficulty overcome by strenuous effort, but within the working collaboratives one did not have to "struggle" as the roles and techniques employed, helped each person to have a more commanding view of the situation thus gaining insights into the exploration of the particular solution paths and leading learners in frequent "aha experiences."

The occasions for sharing, allow teachers to "open up" for suggestions and ideas, to see the commonalties and the differences which exist in each situation, thus, no one is now suspicious of the other, but a trusting collaborative climate is created. One participant said,

> *You are forced to open up, and you are forced to let down your guard. In doing so you open up, and you are not afraid to expose your self. It was not a matter of being afraid if you were right or wrong, you were just open. I think just bringing*

> *in the non-judgmental atmosphere that was strengthened in the workshops helped.* (PDP, October 22, 1997)

Sharing in a non-judgmental, non-evaluative atmosphere allows you to open up, to let down your guard, to be able to think on the spot without inhibition of the thought processes and allows one to be open to the suggested alternatives. Collaboration is sharing and working jointly on a task rather than on separate components (Damon & Phelps, 1989). No value judgement is placed on a response during collaboration, and respect for each person's input is key in the sharing process.

The New Role of the Teacher as Coach in the Development of Trust

Coaching is a non-judgmental, non-evaluative approach which is fostered in an atmosphere of trust (Costa & Garmston, 1994), through the use of elegant linguistic tools (Personal Communication, John Dyer, Trainer and Consultant, Institute of Intelligent behaviour, February, 1997) which enhance another person's perception, decision making, and other intellectual functions without imposition. One participant reflecting on his experience of the meaning he derived in a coaching dyad where he was the coachee stated,

> *Coaching is a means of conveyance. Cognitive coaching is helping an individual to think through a problem situation. It can also be described as the ability to analyse, synthesise, and simplify. It helps the individual to evaluate and assess a situation through the use of good questioning technique. The coaching exercise is basically one that helps the person to make a decision about his or her idea. It helps the person in that, if he needs to make a decision on a particular issue it is done without interference from the coach. It is a facilitating role, not a dictating role. As a coach you are a facilitator not a dictator.* (Seminar, June 24, 1997)

For this participant, coaching means helping a person through the use of questioning technique to arrive at a decision without the imposition of the coach's ideas (Costa & Garmston, 1994), hence the role of a coach is one of a facilitator not one who gives directives. With the role of the coach in mind, one participant stated that, for learning to be enhanced, and for students to develop a love for mathematics, a relaxed atmosphere in the classroom must be created, but in order for this relaxed atmosphere to come about, trust must be in place (Interview, September 22, 1997). This is supported by Costa and Garmston's (1994) statement that learning cannot take place without an

atmosphere of trust.

The grounding or foundation for trust, is acting non-judgmentally (Costa & Garmston, 1994). With only two weeks since the beginning of the school term and teaching this particular group of students for the first time, one participant reflecting on her actual experiences stated that, creating a trusting atmosphere in her class is making a difference. One of the ways that she was translating what she had embodied in the workshop was by making deliberate attempts, and preparing herself mentally as she went to class to eliminate certain words from her vocabulary, which are suggestive of the passing of judgements. She also stated that she was making a conscious effort that her body language in the class did not convey negative messages as well. Even the way she marked students assignments and quizzes are changing, instead of the usual "X" to indicate the incorrectness, she was pointing out the particular instance where the error was made, and why it was probably made.

Removing the judgmental messages, is one of the keys in building trust in the network of relationships which exists in the classroom. So, building a comfortable atmosphere in the classroom she stated,

> *The whole thing of making your class even more comfortable, I think I had a level of it, but it was not deliberate enough to really create a comfortable environment for the children – a trusting one. Even the negative messages, re either what you say or your body language, but deliberately, consciously, creating that atmosphere in the classroom, basically eliminating some words from my vocabulary and my thoughts, mentally preparing to go into the class and deliberately taking out some words. As a matter of fact, I am marking a little quiz now that they have done, and I don't put "X" on the paper, it is either "no" or "you have made this mistake more than once," or something like that. But not just the "X." In other words, I am trying my best not to send across a negative message that would instil fear and making them not wanting to try. ...it is that trusting atmosphere that is being created that is making a difference. I don't reach there as yet but that is what I feel.* (Interview, September 22, 1997)

The fact that the teachers' own ways of translating the experience was different, each person's approach was different, yet they all bear the common threads of the salient elements that bind the system together as a complete unity. With approximately 20 years

of experience in this particular school and coming from the "old school" where "discipline" was the hallmark of the day, Amanda recognized a change in herself since the seminar. She stated that she is now seeing her students and colleagues more as individuals, and respecting them as such. She emphasized that even though our environment has engrained in us distrust for one another, she is learning to build trust and trying not to be judgmental, by eliminating certain suggestive remarks that would convey messages to the students that their opinions were not valued. Instead, she was valuing and respecting the students ideas (NCTM, 1991). With the use of more open-ended questions for small group situation rather than in large group, students are allowed to think and offer their own opinions as each one is valued and respected. Reflecting on what she has been putting into practice in the classroom Amanda stated,

> *I have also learnt to build trust among my students. I see them more as individuals now and also my colleagues. I think that part has really improved since the seminar. ...I am trying* ***NOT*** *to be judgmental (laughs). It is difficult in our situation because you have been cultured to be like that, but I am trying very much to take out the "****NO****! Not like that! How could you think like that? Stupid! Rubbish!" You try not to say those terms and things like that, and a more freedom of expression.... they all want to talk now because you have allowed them to talk, so the freedom of expression I am trying to do that. "Why do you think like that? Tell me how. Explain to the class," and things like that. But we are trying that more in the group work than in the large group situation.* (Interview, September 22, 1997)

She also helped her students to build trust among themselves. She was not tolerating the "*put-downs*" by anyone in the class, instead she allowed them to value and respect each others' ideas as is supported by the Standards (NCTM, 1991).

> Amanda: *I have also learnt to build trust among my students....and a more freedom of expression.*
> Researcher: *You are saying then, that they are allowed the freedom of expression ....*
> Amanda: *within certain confines. They know that when someone else is speaking they cannot say "no you are wrong" and things like that.*
> Researcher: *So, what you are saying now is that, you are also helping the students not to be judgmental in their comments.*
> Amanda: *immm hmmm not to be judgmental too, immm hmmm.* (Interview, September 22, 1997)

Teachers have not only been striving to eliminate the conveyance of negative messages during their interactions with each other and with their students but they have also been striving to eliminate the so-called "positive" judgements as well. Even when expressions like "that is good" come "spilling out" they are quick to explain by asking themselves the question "*Oh what do I mean by good?*" They explain why a particular action was considered "good."

It is felt that praising might help one to experience a feeling of elation but does not do anything to enhance thinking or creativity and might even inhibit creativity (Personal communications, John Dyer, February, 1997). One teacher stated that from her experience she learned that making "*judgmental decisions may interfere with maximum creativity*" on the part of all students who are within that space in which that particular judgement was passed. She further stated that while "*you might be praising a child and saying 'that's good' you might prevent that child from doing further exploration.*" In the same vein you might be passing on a negative message to the others in the setting that the ideas they offered might not be good enough. A child who is told "good" might feel so good so as not to continue to do further explorations for the moment, thus, his thinking is shut down for that moment. Whereas, if a child is told the same thing in a different way, for example, "I see that you have developed the procedures for the solution of the particular problem and have outlined it in a sequential manner with explanations, what are you thinking of doing next?" This might be a "mouthful," but while you are not only motivating the child, you are also suggesting to him or her to go on to more challenging problems since he has understood these initial concepts.

So the non-judgemental approaches inherent in coaching enable teachers to value and respect each other's ideas, thus maximising their creativity, by the non-use of elements that would interfere with thinking. The new role of the teacher is one of a coach, one who is a facilitator and not one who is considered a dictator or one who must be feared. This person is one who can be trusted and whose role it is to create a friendly relaxed atmosphere. The conscious avoidance of judgmental and evaluative words, phrases, and non-verbal messages on the teachers' and the students' parts have led to the creation of a trusting teaching and learning environment.

Conclusions and Recommendations

This section provides a summary of the findings from which the conclusions have emerged. The recommendations for theory and practice are also addressed along with a response to the research question: "How can employing a facilitative approach to professional development utilising the vehicle of cognitive coaching be accommodated to inform and empower teachers to develop alternative modes of teaching in the regular mathematics classroom?"

Summary of Findings

1. Principal's support is key for any set of teachers to "buy into" any professional development activity.
2. Learning experiences for teachers should be enacted. They should be of a fluid nature to target teachers as a collaborative learning community where learning outcomes are not prescribed but allow for discovery learning and learning by understanding, as teachers learn to value and respect each other's ideas and suggestions.
3. Reflection is the act of looking back on our embodied experiences in a personalised way, making meaning of them, and understanding their relevance for the unknown -- the mathematics teaching and learning community (MLP) through *Reflective Coaching Discourses* in a collaborative setting.
4. A comfortable atmosphere is created when verbal or non verbal messages carry no element of intimidation but allows for freedom of expression, a feeling of security, while each one learns from the other in *Reflective Coaching Discourses*.
5. Collaboration in a setting in which no value judgement is placed on each person's response, brings with it sharing of alternatives which fosters creativity, as each person's participation is maximised while working together on the same aspects rather than on separate components.
6. Acting non-judgementally is the grounding for trust in the network of relationships in the mathematical community which must be in place for learning by understanding to take place.
7. The teacher's role in the mathematical community is one of a coach to help students to arrive at a decision without imposition, and creating a trusting relaxed atmosphere

where creativity is maximised.

Conclusions

From the findings the following conclusions have emerged.

1. Principal's support is essential and appears to be related to the level of importance that teachers attach to a professional development program. Without the Principal and his administration's support, the program would probably be a failure, because, other regular activities would have been deemed more important than the program. There would be disruption, because administration would be assigning teachers other duties and making other demands of them while teachers are involved in program.

2a. While the traditional didactic mode of instruction has been universally practised as the chief mode of delivery of instruction, the development of students as thinkers to meet the societal demands, calls for a move away from this to approaches that address "teaching for understanding." Working alone is encroached upon by the "blind spots" of our individualism, but when our space is extended to honour the views of others it allows for "seeing" issues from multiple perspectives; perspectives that, by ourselves, we probably would never have thought of. Hence, the need for others to work as collaboratives aid in the development of our understanding.

2b. Ensuring that the project aligns with teachers' needs do not bring about change in attitude or elicit commitment. But it serves as basis on which to launch. What others say, and what others do, are all external and meaningless to an individual until he or she is changed by his or her own personal experiences.

2c. Teachers do not have to have the evidence of enhanced student learning outcomes before they experience changes in beliefs and attitudes. As they experience changes in their own learning, changes in attitude and beliefs come about and are enhanced by changes in student learning. This is contrary to Guskey's (1985) proposition that significant changes take place in teachers' beliefs and attitudes "only" after enhanced student learning outcomes. To a certain extent I agree, but it does not happen in such a linear way. This project did not take on the mutual adaptation approach nor the fidelity approach (Synder, J., Bolin, F. & Zumwalt, K. (1992) but a more fluid approach. Hence, teachers had to experience the change or growth first and as they

experienced this growth they anticipated the same or better for their students.

2d. We don't learn in a linear way, and it is only as dissonance is created that we will work ourselves through the maze of our observations and past and present experiences and find that opening – the way to do. This to me is learning by understanding, the kind of learning that will never leave an individual.

3. When student learning is made the chief goal of professional development and when outcomes are not prescribed, then teachers in a collaborative setting are "forced" to reflect on each aspect of what they do and see each in the light of student learning. When teachers experience learning for understanding, this causes them to reflect and "leap ahead" envisioning such in the context of math learning for their students. This is what makes professional development meaningful and effective.

3b. The Coaching Approach not only promotes reflection according Sparks-Langer and Colton (1991), but I am suggesting that it commands and demands reflection because of its nature and the comfortable atmosphere that is created.

4. A comfortable non-judgmental atmosphere is necessary so that learners, adults and children, can be free to express their thoughts. It is only in the expression of the thoughts that others will recognise the similarities and differences in them and be able to explore those differences. It is only in the expression of the thought processes that the need for clarity or elaboration can be recognised and addressed so that that which is recondite can be made obvious. This is the grounding for *Reflective Coaching Discourses.*

5. When all individuals in a group in which there is no competitiveness work on the same aspect, each is allowed to explore the particular path in a way that the history of his experiences allow. This history is unique only to the individual himself and as a result each person's way is unique. Collaboratively working on the same aspect also allows for the pooling of thoughts, the filling of gaps in each other's thinking, pursuing different solution paths, but arriving at the same destination, the solution.

6. It is only when we trust, will we allow others "psychological entrance" into "our world", our world of uncertainties, our world of "I don't know how, I don't understand, show me." Allowing someone this entry means "I trust you, you will not

ridicule me, you will not put me down, you will not make me feel dumb." Allowing this entry does not mean it is one directional, it is not a "superior" dealing with an "inferior," not an "expert" dealing with a "novice" but it is a two-way street, the feelings are reciprocated, it is a collaboration. Therefore, the teacher is free to explore, and venture on a path that might not take him or her to a predetermined destination. With trust for one's coach comes the ability to take professional risks in the classroom.

7. It is critical to accept multiple learner perspectives regarding "best" approaches to learning in classroom because the teacher's method of solution might not necessarily be the students' ways of solving a particular problem. Each one might see the same thing differently according to each person's personal history yet arriving at the same destination – the solution.

Recommendations For Theory and Practice

Given the conclusions reached in this study, I suggest the following recommendations for theory and practice.

1. That Administrators
   (a) should be involved in the planning process.
   (b) provide support by being flexible in time-tabling (e.g., redesign structures to support collaboration).
   (c) re-think schedules to create blocks of time for subject teacher collaborative groups and professional development time.
   (d) free teachers for professional development by creative group arrangements (e.g., freeing math teachers by grouping math classes with other subject groups for the professional development period).
   (e) should keep abreast with teachers and researcher to be informed about the progress of the process.
   (f) should communicate with students regarding their progress and make time to become a part of the process by teaching a class or two.
   (g) should be involved in professional development sessions, sharing their

expertise and knowledge with teachers and become a part of the collaborative culture.

(h) might have to mandate the forming of collaboratives for some teachers to participate.

(i) might have to re-think summative evaluations and have more collaborative formative evaluation.

2. Teachers as individuals should participate in both phases of the seminar series in order to "buy in" to the notion of cognitive coaching to:

(a) recognise it's potential value for the classroom situation.

(b) appreciate the value and use in everyday life.

(c) assimilate and accommodate the process into their teaching repertoire.

(d) make direct link from what they were experiencing to the classroom situation.

(e) see the importance of withholding judgements in the collaborative setting.

3. Teachers in their Learning Communities

(a) need to overcome the notion that teaching is purely an individual act.

(b) also need to overcome the notion that learning is purely an individual act.

(c) learn by understanding when outcomes of their collaboration are not prescribed, but are emergent and consistent with the needs of teachers and their perception of the needs of their students.

(d) need their space to decide and try out on their own what is most important to them without directives as to what to do first and next, or how to do what, and when to do what.

(e) need time in order to carry out reproduction of techniques and processes learnt, so how these are accommodated should be the focus of coaching dyads.

(f) may begin to request the collection of specific data on particular strengths and weaknesses when techniques and processes are reproduced to a great extent in the learning situation.

(g) need to share their own experiences and the experiences of their students with one another as a group and on a one to one basis.

The Research Question

In light of the findings listed, the research question posed at the beginning will now be addressed. How can employing a facilitative approach to professional development utilising the vehicle of cognitive coaching be accommodated to inform and empower teachers to develop alternative modes of teaching in the regular mathematics classroom?

For the coaching techniques to be accommodated, they first had to be embodied by making meaning of each in the context of teachers' own experiences in order to effectively reshape and organise them, to have others – the learners, experience what they experienced, thus reproducing the experience. To give teachers the opportunity to accommodate this, the setting had to be conducive to such. The Principal's input in creating the culture for such is very important. It is only as the administrators set the climate where teachers experience the freedom to do as is required, that accommodation will place.

It is only as directives are removed and specified outcomes are not prescribed; as teachers value and respect each other's input that they will be able to learn from each other in ways that are now made accessible through their collaborative learning community. As they experience this in the collaborative communities they are able at a later date to do the very things on their own (Vygotsky, 1978).

Through the comfortable atmosphere created by the elimination of verbal and non-verbal judgmental messages, teachers will be free to express their thoughts, knowing that the thoughts even though they might not be of immediate use, will be important some where along the "journey" to the solution of the particular problem. Thus, an idea might open up a new path that was never explored before, yet leading to the solution. Individuals can, therefore, reflect and make meaning of their own action and experiences as well as the contributions of others to such. The constant sharing of alternative ways of doing while working on the same task, triggers other ideas, fills gaps, provide elaborations, clarifications, and specificity, while maximising each person's participation in an orderly manner, as individuals function in their particular role.

This is engendered by the trust that has been developed in the network of

relationships. Through the activities and opportunities for openness, trust is created among and between individuals making the mathematics learning community rich with ideas and alternatives. Teachers pregnant with ideas and repertoire now enter the classroom and begin the way they know best, whether by introducing techniques linearly or in clusters, depending on the needs of their students and how they perceive their students, they launched out to "reproduce." The reproduction will not suffer from immaturity and die because the collaborative community is alive. The feedback from students' experiences aid the reciprocity and circularity inherent in the math learning community involving teacher collaboratives and student collaboratives. Thus cognitive coaching is accommodated through the fluid nature of the professional relationships that form among teachers, among students, and between teachers and students thus generating *Reflective Coaching Discourses*.

Cognitive coaching as the vehicle for professional development is an action and experience, not just on the physical level but in the way we communicate. The pathway for communication generated by the "membranous boundary" of cognitive coaching establishes the circularity and reciprocity inherent in the relationship between action and experience. The dynamically relatedness of the components of coaching depicts an ongoing set of "metabolic activities" within the system. These were aimed at an awareness and acquisition of the techniques embedded in *Reflective Coaching Discourses*.

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